

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
4 November 2004 (04.11.2004)

PCT

(10) International Publication Number
WO 2004/094986 A3

(51) International Patent Classification⁷: **G01N 27/327**

(21) International Application Number:
PCT/US2004/011900

(22) International Filing Date: 16 April 2004 (16.04.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/463,047 16 April 2003 (16.04.2003) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:
US 60/463,047 (CON)
Filed on 16 April 2003 (16.04.2003)

(71) Applicant (for all designated States except US): **HANDY-LAB, INC.** [US/US]; 5230 S. State Road, Suite 100, Ann Arbor, MI 48108-9754 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ALTHAUS, John, S.** [US/US]; 3053 Burr Stone Court, Saline, MI 48176 (US). **KYONGHOON, Lee** [KR/US]; 215 Lake Village Drive, Apt. 104, Ann Arbor, MI 48103 (US). **NAMASIVAYAM,**

Vijay [IN/US]; 3073 Signature Boulevard, Apt. F, Ann Arbor, MI 48103 (US). **BRAHMASANDRA, Sundaresh, N.** [IN/US]; 458 Waymarket Drive, Ann Arbor, MI 48103 (US). **HANDIQUE, Kalyan** [IN/US]; 120 Lake Village Drive, Apt. 104, Ann Arbor, MI 48103 (US).

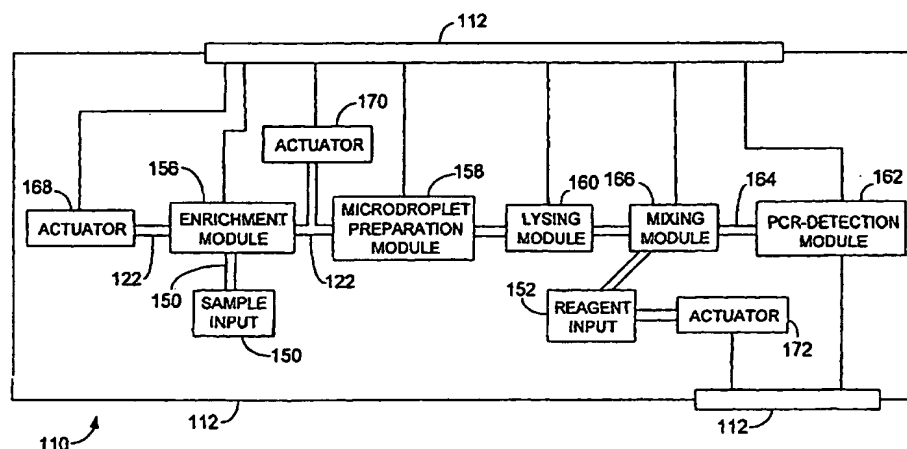
(74) Agent: **FISTER, Julius, C., III**; Fish & Richardson P.C., 1425 K Street, NW, Washington, DC 20005 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US (patent), UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,

[Continued on next page]

(54) Title: **SYSTEM AND METHOD FOR ELECTROCHEMICAL DETECTION OF BIOLOGICAL COMPOUNDS**



(57) Abstract: The present invention relates to an electrochemical method for detecting a target polynucleotide. An electrode comprising an electrode surface is provided. The electrode surface includes at least one probe molecule reversibly immobilized with respect to the electrode surface. A first electrochemical signal indicative of an amount of probe molecule immobilized with respect to the electrode surface is obtained. The electrode surface is contacted with a liquid comprising the target polynucleotide. Upon the contacting step, at least some of the probe molecule immobilized with respect to the electrode surface dissociates therefrom. A second electrochemical signal indicative of an amount of probe molecule immobilized with respect to the electrode surface is obtained. The presence of the target polynucleotide is determined at least partially on the basis of the first and second electrochemical signals.

WO 2004/094986 A3



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:

17 February 2005

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/11900

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01N 27/327

US CL : 205/777.5

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 205/777.5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE-LOS-SANTOSALVAREZ et al. ("New scheme for electrochemical detection of DNA based on electrocatalytic oxidation of NADH," Electrochemistry Communications (March 2003), 5(3), 267-271).	54-56
X	CHO et al. ("Fabrication of a Multi-Electrode array DNA Sensor for Electrochemical Genotyping," Journal of the Korean Physical Society, vol. 41, No. 6, december 2002, pp. 1054-1057).	54-57, 61, 62, 64, 65
---		-----
Y		58, 63

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

01 December 2004 (01.12.2004)

Date of mailing of the international search report

10 DEC 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Alex Noguera

Telephone No. (571) 272-1300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/11900

Continuation of B. FIELDS SEARCHED Item 3:

EAST, CAPLUS

search terms: oligonucleotides, polynucleotides, nucelic, DNA, RNA, intercalat?, electroanalytical, electrochemcial,electrode, probe, dye, methylene blue,anthracycline,daunomycin,doxorubicin,toluidine,azure,thionin